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FOLLOW-UP TO THE NORMAN WELLS OILFIELD EXPANSION AND PIPELINE DEVELOPMENT PROJECT

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WELLS OILFIELD EXPANSION
AND PIPELINE DEVELOPMENT
PROJECT

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LIST OF ACRONYMS AND ABBREVIATIONS

DIAND - Department of Indian Affairs and Northern Development
DOE - Department of Environment

EA Panel - Environmental Assessment Panel
EARP - Environmental Assessment and Review Process
EIA - Environmental Impact Assessment
EIS - Environmental Impact Statement
EP - Environmental Protection
EPS - Environmental Protection Service

FEARO - Federal Environmental Assessment and Review Office

IPL - Interprovincial Pipelines Limited

NEB - National Energy Board
NWP - Norman Wells Project

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1. INTRODUCTION

The Department of Environment (DOE) participated in different aspects of the environmental review and approval processes applied to the Norman Wells Oilfield Expansion and Pipeline Development Project. The Department identified potential environmental impacts relating to the development proposal during the review and approval processes.

This report results from a study to determine the extent to which potential impacts identified by DOE, relating to both the Norman Wells pipeline and the oilfield expansion, were addressed:

1. in the Environmental Assessment Panel (EA Panel) report; and,
2. through regulatory processes (water licensing, land use permitting) in which DOE participated,

and subsequently were incorporated into project design, construction and operation.

The second purpose was to evaluate the use of "desk-top" post-project follow-up as a tool to determine the effectiveness of DOE's involvement in environmental review and approval processes.

2. BACKGROUND

The Norman Wells Project involved the expansion of an existing oilfield at Norman Wells and the construction of a buried pipeline to transport the oil to northwest Alberta. The increased production required 200 oil and water injection wells, six artificial islands in the Mackenzie River, an oil gathering system and a central processing plant. The pipeline is 866 km long with a 324 mm diameter. As described by FEARO (1981), the "pipeline route begins at Norman Wells and follows the east side of the Mackenzie River to a crossing point upstream of Fort Simpson and then southeast to the Zama terminal of the Rainbow pipeline in

northwest Alberta" (FEARO, 1981). The pipeline was constructed by Interprovincial Pipeline Limited (IPL); the oilfield expansion was undertaken by Esso Resources Canada (Esso).

Pipeline construction began in December 1982 with clearing of the right-of-way and was completed in consecutive winters, ending April 1985. Oilfield expansion commenced in January 1983, with construction of the artificial islands. Production from the expanded facilities began in March 1985. Full-scale integrated operations began in April 1985.

The Norman Wells oilfield expansion and pipeline project, particularly the pipeline component, was subjected to a number of review processes. The first was an EA Panel review, under the federal Environmental Assessment Review Process, of both the oilfield and pipeline components. The EA Panel concluded "that before the Norman Wells Project can be built within acceptable limits of environmental and socio-economic impact, important deficiencies in the proponent's planning and in the preparedness of government need to be rectified. The Panel therefore recommends that the project not be proceeded with until 1982 at the earliest, in order that these deficiencies can be dealt with" (FEARO, 1981).

Interprovincial Pipeline (IPL) also required National Energy Board (NEB) approval to construct the pipeline and move the oil to Alberta. In its "Reasons for Decision", March 1981, the Board reached the same major conclusion as the EA Panel; the project was environmentally acceptable, provided certain studies were conducted and the results incorporated into the project's design. Results from further studies had to be approved by the Board prior to project construction.

Both Esso and IPL required Northwest Territories Water Board licenses. The Esso license was required for the disposal of drilling fluids, wastes and cooling water and for the use of water for drilling camps,

well drilling, waterflood and central processing facility cooling. Esso received its water license in July 1982. IPL required the NWT Water Board licenses to cross the Great Bear and Mackenzie Rivers. The two licenses were issued to IPL in January 1983.

A full project chronology is provided in Table 1.1

DOE participated in the EA Panel review of the Norman Wells Project. The Department was represented at all the EA Panel hearings and presented both opening and closing statements as well as other presentations based on technical reviews of the Environmental Impact Statement.

DOE did not participate in the National Energy Board review of, and hearings on, the Norman Wells Pipeline but did assist the Government of the Northwest Territories in the preparation of its review . (Note: DOE does not normally intervene in NEB reviews and hearings; in fact, DOE has only been directly involved in one National Energy Board hearing.)

DOE participated in the regulatory review for the water licenses; the Department was represented at the hearings and made a written submission to the Water Board. Land Use permits and leases were issued by the Department of Indian Affairs and Northern Development (DIAND) for the Norman Wells Project; DOE reviewed them.

Table 1.1

NORMAN WELLS PROJECT - PROJECT CHRONOLOGY

1 February 1980	-	project referred to FEARO for EA Panel Review
17 March 1980	-	IPL filed application to NEB to construct and operate pipeline
April 1980	-	EIS received by EA Panel
May 1980	-	Esso made application to NWT Water Board to construct artificial islands and develop oilfield
late July 1980	-	deficiency statement released by EA Panel
early August 1980	-	additional deficiency statement released by EA Panel
8 August 1980	-	Esso response to first deficiency statement
22 August 1980	-	EA Panel request for further information
25 August 1980	-	Esso response to second deficiency statement
11 August - 1 September 1980	-	EA Panel public hearings
7 October - 12 November 1980	-	NEB hearings
January 1981	-	EA Panel Report released
February 1981	-	NWT Water Board hearings regarding artificial islands in Norman Wells and Fort Good Hope
March 1981	-	NEB's Reasons for Decision released
June 1981	-	NWT Water Board hearings regarding artificial islands in Inuvik and Ft. MacPherson
1 July 1982	-	NWT Water License issued to Esso for island construction, oilfield development and extraction and production of oil and gas
December 1982	-	pipeline construction began
1 January 1983	-	NWT Water License issued to IPL for pipeline construction and operation - Great Bear River and Mackenzie River
January 1983	-	artificial island construction began
April 1985	-	Norman Wells Project began operation

3. PREVIOUS FOLLOW-UP ON NORMAN WELLS PROJECT

3.1 Department of Environment

In 1982, A. Bryant prepared a report for the Environmental Protection Service that examined DOE's participation in the environmental review of the Norman Wells Project. "This study was commissioned to investigate and report upon the quality of DOE's participation in EARP and the extent to which the Department's environmental concerns are being resolved through follow-up" (Bryant, 1982). The study identified the number of concerns raised by DOE that were addressed during the EA Panel review or incorporated into the Panel recommendations. Bryant determined the extent to which recommendations resulting from DOE's intervention had actually been incorporated into the construction and operation of the project. Each of the concerns identified by DOE through the EA Panel, along with any ensuing action, are listed in Appendix 1. The list is based on Bryant (1982).

Of the twenty-seven environmental and engineering recommendations made by the EA Panel, "twelve can be directly attributed to DOE's participation in the public hearings" (Bryant, 1982). (The twenty-seven engineering and environmental recommendations are listed in Appendix 2.) Three of the twelve were either resolved or addressed at the time A. Bryant completed his report. These three recommendations, and the resultant action, are discussed below.

11. It is further recommended that studies on alternatives to filter cloth protection be carried out to find a material that will ensure that no significant erosion of the islands will occur. Results should be reviewed by government before construction of the islands is authorized.

After the hearings, Esso prepared a report entitled Filter Fabric: Its Use on Norman Wells Production Islands (Esso Resources, 1980). The report was reviewed by DOE personnel from the National Water Research

Institute. It was concluded that there was no alternative to the use of filter cloth. DOE's concerns were resolved.

Further design and monitoring studies were undertaken with respect to the artificial islands. These are discussed in the next section under EA Panel recommendation Number 10.

19. It is recommended that Esso undertake an accelerated research and technology development program on equipment and procedures to deal with oil spills into or under ice-covered and ice-infested river waters. This program should be in place before expanded production begins at Norman Wells.

Prior to the hearings, Esso had been an active participant in research dealing with oil spill clean-up by supporting and undertaking research in the Arctic, on the East Coast and in the Western Provinces (Esso Resources, 1981).

After the hearings, Esso stated that it would continue to play an active role in oil spill research. The company also undertook studies in 1982 to identify sensitive environmental areas and to examine oil spills under ice. Further follow-up to this recommendation was not required as DOE's concern was addressed.

20. It is recommended that Esso investigate, design and install a more accurate oil-leak detection system at Norman Wells, one that would be consistent with the detection levels of the IPL pipeline to Zama.

The IPL pipeline transmits a single phase fluid, while the field gathering system transmits a mixture of oil, gas and water. The former fluid is relatively incompressible; the latter is highly compressible. Leak detection systems become less accurate the more compressible the material being transported. Therefore, the oil, gas and water mixture "can not be metered to the same accuracy limits as a single phase fluid" (Esso, 1981). DOE accepted this explanation; further DOE follow-up was not required.

The remaining nine recommendations resulting from DOE's intervention are listed in Table 3.1 and are discussed in Section Four.

3.2 Norman Wells Research and Monitoring Program

In 1982, the intergovernmental Norman Wells Research and Monitoring Program for the oilfield expansion and pipeline project was initiated. The Program has four objectives:

1. to determine and quantify environmental impacts and to examine recovery processes;
2. to compare actual and predicted impacts;
3. to evaluate the long-term effectiveness of mitigative measures; and
4. to prepare environmental recommendations applicable to future northern pipeline developments (EPS, 1986).

A Working Group was formed to implement the program and includes members from the federal government, territorial government, Dene Nation, Esso Resources and IPL. Close to twenty studies have been initiated to address the objectives of the program. The results of some of these studies are discussed in following sections. The Department of Environment played an instrumental role in developing the program and now coordinates the activities of the Working Group.

TABLE 3.1

Outstanding Panel Recommendations

3. It is further recommended that, before the project is authorized, IPL undertake and publish a more detailed thermal analysis of the pipeline to predict more accurately the behavior of the pipe in a variety of terrain and temperature regimes. The analysis should cover the possibility of climatic change over the life of the project.

6. It is recommended that in developing oilspill prevention and contingency plans, IPL make special provisions for the karst terrain near Bear Rock.

10. It is recommended that Esso carry out a model study to fully evaluate local scour of the artificial islands in order to be certain of the structural safety of the pipelines and integrity of the islands. The study should include monitoring and remedial repair procedures. The results should be reviewed by government before the island construction is authorized.

14. It is recommended that IPL undertake baseline studies on hunted and trapped species to provide information aimed at both the assessment of the impact of the pipeline construction and operation on wildlife, and the development of mitigation measures.

15. It is recommended that construction and drilling activity on the islands stop during the peak spring waterfowl migration period that normally lasts one to two weeks, and that helicopter access to the islands be restricted to only essential needs.

16. It is recommended that Esso develop a plan specifying the necessary equipment and procedures to keep large populations of waterfowl away from an oil spill site.

21. It is recommended that Esso and IPL develop, test, and evaluate contingency plans for the construction and operation of both the oilfield expansion and pipeline projects and that these plants be reviewed and approved by government prior to the start of construction.

23. It is recommended that Esso commence a monitoring program for ground level concentrations of air emissions in the Norman Wells area and that this monitoring continue throughout the length of the project.

24. It is recommended that no drilling wastes other than mixtures of water and bentonite be allowed to enter the Mackenzie River and that land disposal and treatment sites be identified and developed.

4. STATUS OF EA PANEL RECOMMENDATIONS RESULTING FROM DOE'S INTERVENTION

The Department of Environment's 1982 follow-up to the twelve EA Panel recommendations resulting from DOE's intervention was discussed in Section 3. Of the twelve EA Panel recommendations, three had been addressed (in 1982) and further follow-up was suggested for the other nine. A discussion of the extent to which each of the nine recommendations have been implemented follows.

3. It is further recommended that, before the project is authorized, IPL undertake and publish a more detailed thermal analysis of the pipeline to predict more accurately the behavior of the pipe in a variety of terrain and temperature regimes. The analysis should cover the possibility of climatic change over the life of the project.

A more detailed thermal analysis of the pipeline was undertaken by IPL for submission to the National Energy Board. A condition of the Board's project approval (March 1981) required further work on thermal design prior to pipeline construction. Final designs had to be approved by the Board before final project approval was granted. The condition was met by IPL.

Although the NEB required a detailed thermal analysis, the Board did not request the inclusion of 'climatic change' in the analysis. It is likely that this was because the effect of climatic change on pipeline integrity would be minimal relative to other variables such as seasonal climate changes and the effect of right-of-way clearing on the thermal regime (C. Taylor, NEB, pers. comm.).

Through the Norman Wells Research and Monitoring Program, the Department of Energy, Mines and Resources (in cooperation with DIAND and IPL) has undertaken two monitoring programs related to this recommendation. The first deals with terrain performance and "is directed toward the observation and prediction of geomorphic and geologic conditions along the Norman Wells to Zama pipeline route" (EPS, 1986). This monitoring

will be continued until at least 1989 "in order to assess long-term terrain stability in relation to an operating northern pipeline". Thermal regime and ground stability are being monitored through the second study. The objectives include monitoring changes in the active and permafrost layers, assessing thermal and ground disturbances and evaluating erosion controls and restoration techniques. This study is expected to last at least 10 years.

6. It is recommended that in developing oilspill prevention and contingency plans, IPL make special provisions for the karst terrain near Bear Rock.

The NEB requested IPL to produce oilspill prevention and contingency plans. While a contingency plan was not provided to the EA Panel, this information was provided to the Board prior to pipeline construction. IPL identified the location of karst terrain and recognized the problems of cleaning up oil spills in karst terrain in its contingency plan prepared for the NEB. Specific measures for this type of terrain were not developed; in case of an oil spill, IPL will implement standard containment and clean-up operations. Unlike the EA Panel, the NEB did not require special provisions for the karst terrain near Bear Rock. Geophysical surveys showed that karst terrain did not occur on the pipeline right-of-way but the Board recognized that there was karst terrain in the area of the pipeline route. Due to the impracticality and difficulty in retrieving oil in karst terrain, the Board placed emphasis on preventing and containing spills. The Board's approval conditions focused on potential volume of spilled oil and ensuring effective surface containment and control mechanisms (C. Taylor, NEB, pers. comm.).

10. It is recommended that Esso carry out a model study to fully evaluate local scour of the artificial islands in order to be certain of the structural safety of the pipelines and integrity of the islands. The study should include monitoring and remedial repair procedures. The results should be reviewed by government before the island construction is authorized.

Esso completed studies confirming the structural safety of the pipelines and integrity of the islands prior to oilfield expansion. Esso's studies that assessed the potential for scour showed that while some erosion might occur, monitoring and regular maintenance would eliminate the risk of island failure or pipeline exposure. Results of a "model study showed that the rip-rap design was adequate at specified maximum design flow conditions" (Esso Resources, 1981).

Esso's study results were reviewed by DOE staff from the National Water Research Institute in February 1981. They were satisfied with the island design and felt "that the clay will erode at a rate slow enough for remedial measures to be taken by filling in the scour hole as it develops" (Dick, 1981).

The provision of monitoring and remedial repair procedures was a condition of Esso's water license. A proposed monitoring/repair program was submitted to the Water Board on 20 May 1983 and subsequently approved. Esso is required to submit an annual report on the condition of the islands for review by the Board.

Esso also regularly advises the Norman Wells Research and Monitoring Group of the physical condition of the islands.

14. It is recommended that IPL undertake baseline studies on hunted and trapped species to provide information aimed at both the assessment of the impact of the pipeline construction and operation on wildlife, and the development of mitigation measures.

IPL monitored wildlife to evaluate the impacts of pipeline construction and operation on trapped and hunted species. The objectives of the monitoring program were clearly established to meet the EA Panel recommendation as they included the following:

"a) to evaluate the environmental impact of the pipeline construction and operation,

b) to identify the need for remedial measures and/or a change in design or procedures,
c) to assess the effectiveness of environmental protection measures" (IPL, 1986).

Monitoring was done before, during and after construction. IPL did baseline monitoring from 1980 to 1982. This included moose surveys along the pipeline route and Mackenzie River, wildlife surveys of borrow pits and facility sites and waterfowl surveys before and during break-up. Construction monitoring took place from 1983 to 1985 and included three programs: 1. wildlife track counts along the right-of-way during construction (1984 and 1985); 2. measurements of track densities and browse use along sampling transects; and 3. sighting records of wildlife encountered by IPL, contract and regulatory personnel. Post-construction monitoring included aerial surveys (moose densities), track count surveys, track observations on right-of-way and wildlife observations during weekly surveillance flights.

The results of IPL's monitoring indicate that the pipeline has not resulted in significant adverse impacts on hunted and trapped species (EPS, 1986). IPL monitoring programs will be terminated in 1987.

The Department of Renewable Resources, Government of the Northwest Territories (Policy and Planning Division) also carried out wildlife monitoring on the Norman Wells Project. Wildlife disturbance, renewable resource harvests and wildlife sightings were documented. Study results will be available in the fiscal year 1987/88 (S. Matthews, GNWT, pers. comm.).

15. It is recommended that construction and drilling activity on the islands stop during the peak spring waterfowl migration period that normally lasts one to two weeks, and that helicopter access to the islands be restricted to only essential needs.

In Esso's EARP Report Recommendations Response Status (1981), a commitment was made to cease drilling activities during this period on

Goose Island but not on Bear Island. The justification was given that "drilling locations on Bear Island are away from areas used by geese". In the spring of 1982, Esso made an application to the Canada Oil and Gas Lands Administration (COGLA) for a Drilling Program Approval to drill on Bear Island during the spring of 1983. The Canadian Wildlife Service (CWS) recommended that the proposed drilling activity be stopped during the migration period as outlined in Panel recommendation #15 (Allen, 1982); COGLA attached this condition to the Drilling Program Approval. In the winter of 1983, CWS decided to monitor the effect of the Norman Wells oilfield expansion project on waterfowl use of the islands during migration. It was felt that because of the low levels of activity planned by Esso, "it would not be necessary for operations to shut down during the entire migration period as recommended by the Panel. This would provide an opportunity for studying the effects of Esso's operations on spring waterfowl populations and habitat use in the vicinity of the expansion project" (Boothroyd, 1985). The 1983 Drilling Program Approval was amended and the standby period for drilling was reduced. Boothroyd (1985) found that the main source of disturbance from drilling activites on the islands was helicopter flights, however, waterfowl responses were "minor and short-term". The author concluded that drilling activities and oilfield operation would not have significant adverse effects on the waterfowl.

Esso has complied with the following four conditions during the migration period since 1983 and will continue to do so (C. Sikstrom, Esso, pers. comm.).

a) limiting ground activity to "essential" areas and times during migration;
b) minimizing helicopter service flights;
c) approaching Goose Island from Bear Island by helicopters; and,
d) maintaining minimum, safe altitudes by helicopters.

16. It is recommended that Esso develop a plan specifying the necessary equipment and procedures to keep large populations of waterfowl away from an oil spill site.

The Norman Wells Response Oil Spill Contingency Plan (Esso Resources, 1985) makes reference to waterfowl deterrence in the event of an oilspill. While the potential need for waterfowl deterrents is recognized, specific procedures and equipment are not covered in the contingency plan. "If oily water threatens open water ice leads when migratory birds are present or are expected, clean up the affected area immediately, or make it unattractive to waterfowl and other migratory birds, then clean up the spill as soon as ice conditions permit. Confirm the success of the deterrent program implemented by observing local ice conditions and studying waterfowl behavior" (Esso Resources, 1985).

It is Esso's view that if there is an oil spill in ice-infested waters, then there will be considerable activity with helicopters and clean-up operations; specific waterfowl deterrents may not be required. Specific tactics were not included in the contingency plan because the method of deterrence depends upon specific ice conditions, number of waterfowl at the site and other activities taking place on site. "In general, Esso's spill response actions by themselves would serve as a deterrent to waterfowl near a spill location. However, Esso would be prepared to use special deterrent methods such as propane cannons and explosive cracker shells, if necessary" (Sikstrom, 1987).

21. It is recommended that Esso and IPL develop, test and evaluate contingency plans for the construction and operation of both the oilfield expansion and pipeline projects and that these plans be reviewed and approved by government prior to the start of construction.

Esso did prepare an oil spill contingency plan for the Norman Wells Expansion Project. "The document was reviewed by the Department of Environment and was generally found to be excellent" (Esso,1981).

Two IPL contingency plans were prepared for the NEB. The first was required for construction. The second was for the operation of the pipeline and was required prior to "leave to open". These were reviewed and approved by the NEB; DOE was not involved in their review.

The provision of contingency plans was also a condition of the three water licenses issued to IPL and Esso. For each license, an oil spill contingency plan, hazardous waste contingency plan and a general contingency plan were required. These plans must be reviewed and updated annually by the licensee and submitted to the NWT Water Board for approval. Annual oil spill response exercises are required under the water licenses. Oil spill and boom deployment exercises were undertaken by IPL and Esso in the summers of 1985 and 1986. Personnel from DOE attended both exercises and prepared reports dealing with the review and assessment thereof (Gordon, 1986; Simpson, 1986).

23. It is recommended that Esso commence a monitoring program for ground level concentrations of air emissions in the Norman Wells area and that this monitoring continue throughout the length of the project.

In response to this recommendation, Esso and EPS (NWT) began a joint air sampling program in June 1981. "The purpose of the program was to determine the effect of the expansion project on ambient concentrations of total suspended particles before, during and after construction" (EPS, 1986). Ambient lead concentrations were also measured. Ambient particulate material was monitored because this form of air pollution can affect visibility, health and soil materials. "The Environmental Protection Service's experience in northern air quality and pollution measurement suggested that the Norman Wells Project was more likely to affect ambient particulate concentrations than any other parameter" (EPS, 1986).

An air quality monitoring program was also set up by Esso Resources to determine air quality in Norman Wells before and after project start-up. Monitoring was carried out three months prior to, and three months after, the new facilities began operation. Levels of H_2S, NO, NOx and NO_2 were monitored as well as wind speed and direction. Clean Air Act acceptable levels were never exceeded and it was concluded that "start-up of the Central Process Facilities had no apparent impact on air quality" (EPS, 1986).

24. It is recommended that no drilling wastes other than mixtures of water and bentonite be allowed to enter the Mackenzie River and that land disposal and treatment sites be identified and developed.

Esso's application to the Northwest Territories Water Board included a plan "to collect drilling fluids and transport them to sumps or pits on Bear and Goose Islands and the mainland area" (Esso, 1981). The application included storing the fluids on the islands during break-up and freeze-up and then taking them to land-based pits when conditions allowed.

The conditions of Esso's water license fulfilled this EA Panel recommendation. "The Licensee shall not discharge drilling fluid waste to the Mackenzie River. All Island drilling fluid wastes must be stored in temporary facilities for transportation and disposal to approved sumps ... The Licensee shall contain all wastes on the Islands within the approved impermeable lined dyked areas and shall direct all contaminated internal drainage to sumps for approved disposal on the Mainland" (NWT Water Board, 1982). In 1986, Esso Resources again applied to dispose of drilling muds in the Mackenzie River; the application was turned down by the Water Board (B. Wilson, DOE, pers. comm.).

DIAND is responsible for compliance monitoring with respect to water licenses. As of February 1987, DIAND stated that Esso has complied with the condition of the water license prohibiting disposal of drilling wastes into the Mackenzie River (R. Kent, DIAND, pers. comm.).

SUMMARY

This post-construction follow-up study has demonstrated that most of the Department of Environment's concerns were addressed through the Environmental Assessment Panel review process. Bryant showed that some of DOE's concerns were incorporated into the EA Panel's requests for additional information and addressed by the proponents responses to these requests prior to and during the hearings. Most of the Department's concerns, however, were addressed through EA Panel recommendations.

All of the twelve recommendations resulting from DOE's intervention have been implemented in the project design, construction or operation, but to varying degrees. For example, as per recommendation #24, no drilling wastes enter the Mackenzie River and land treatment and disposal are used; this recommendation has been fully implemented. The recommendation (#3) that IPL undertake a detailed thermal analysis was implemented, but the analysis did not cover the possibility of climatic change as was suggested by the EA Panel. It should be noted that the environmental impacts associated with the three recommendations that were not fully implemented (#3, #6, #16), were recognized by the proponents and/or the National Energy Board.

Although a recommendation arising from DOE's intervention may have been implemented, the Department's concerns may not necessarily have been addressed. For example, it was recommended (#23) that a monitoring program be undertaken for ground level concentrations of air emissions. DOE had raised the concern that air pollutants could result in 'serious' ice fog

conditions. A monitoring program, however, does not address the problem (i.e. the recommendation does not deal with how to avoid or alleviate the condition). While this is certainly a reflection of a shortfall in the EA Panel recommendations, it also suggests that DOE should focus on mitigation measures, in addition to identifying potential environmental impacts, during project reviews and EA Panel hearings.

It is difficult to determine whether DOE concerns were addressed by the initiator or proponents as a result of the EA Panel review or as a result of subsequent regulatory reviews. The federal Environmental Assessment and Review Process does not have a legislative basis; proponents and initiators are not bound by law to comply with the EA Panel recommendations. The Process relies upon the integrity of all the involved participants to ensure that the 'recommendations' are implemented in project design, construction and operation. Some of the EA Panel recommendations were also contained in the regulatory stipulations of other reviewing agencies (NEB, NWT Water Board, DIAND). These include recommendations #3, 6, 10, 21 and 24 (see Table 3.1). It is not certain whether these recommendations would have been implemented by the proponent if they had not been covered under other regulatory requirements.

5. LAND USE PERMITS

A number of land use permits, and subsequent amendments, were required for the Norman Wells Pipeline. Environmental concerns regarding pipeline construction raised during the Panel review were also addressed in the terms and conditions of land use permits. Land use permits are issued by DIAND under the Territorial Land Use Regulations of the Territorial Lands Act. DIAND issued land use permits to IPL for right-of-way clearing, permanent facility sites, temporary off right-of-way facilities (e.g. camps), mainline construction, borrow sites and spoil disposal. The Land Use Advisory Committee (LUAC) reviews all applications for land use permits and has members from DIAND, the Government of the Northwest Territories (Department of Renewable Resources), the Department of Fisheries and Oceans, and the Department of Environment. While all the land use permits were referred to LUAC for review, amendments were not. For example, verbal permit amendments were extended for timber harvest sites and spoil disposal areas without notification of LUAC members (GNWT, 1986).

A search was made of DOE's LUAC files on the Norman Wells Project in both Edmonton and Yellowknife. There were no records of any environmental concerns raised by DOE. One of the following must therefore be assumed:

1. DOE did not have any environmental concerns;
2. concerns were relayed to DIAND verbally because of time constraints; or,
3. it was not necessary for DOE to identify concerns because they were already addressed within DIAND's standard land use conditions.

6. WATER LICENSES

The Department of Environment, Western and Northern Region, made a submission to the Northwest Territories Water Board regarding Esso's application for water use and industrial waste disposal for the Norman Wells oilfield expansion project. Environmental concerns regarding island and pipeline construction and operation raised during the Panel review were also addressed in the the terms and conditions of water licenses. The submission outlined five areas of concern to the Department.

1. Artificial Islands - DOE was concerned about the integrity of the artificial islands and the "uncontrollable escape of oil from the islands to the river". DOE recommended that systematic monitoring of the islands integrity be undertaken to prevent oil spills. This concern was addressed in Esso's water license. The following sections of the license apply (NWT Water Board, 1983).

Part A. 5.b The Licensee shall file an annual report...which shall contain a summary of...the physical condition of each Island, including inspections of each Artificial Island and vicinity for channel erosion, Island scour and erosion, at the Pipeline landfalls and condition of rip rap.

Part C.3. The Licensee shall ensure no flow of formation fluid to surface is possible from any well on an Artificial Island until at least one Artificial Island has experienced one post-construction breakup period. A survey of the conditions of the Island shall be carried out, and a detailed report satisfactorily demonstrating Artificial Island integrity submitted to the office of the Board in support of Island - based drilling during River Ice Breakup.

Part C.4. The Licensee shall terminate all Artificial Island based drilling and minimize storage of drilling and petroleum products on Islands during the River Ice Breakup period of the first year of operation.

Part C.5. The Licensee shall undertake any necessary annual maintenance required to preserve the structural integrity of the Islands.

2. Leak Detection in the Oil Collection and Transportation System DOE was concerned with potential chronic leaks (from field collection and transportation systems) below detection limits, and the resultant environmental impacts. DOE recommended that an improved leak detection system be investigated and that Esso commit itself to the development thereof. This concern was addressed through the following sections of the Water License.

Part A. 5.1. The Licensee shall file an annual report...which shall contain a summary of...a progress report on the upgrading of the leak detection capabilities of the oil collection Pipeline.

Part C.6. The Licensee shall check for leakage and undertake hydrostatic pressure tests on the portion of the Pipeline carrying oil, gas and water from the oilfield reservoir to the Central Processing Facility.

Part C.8. The Licensee shall immediately shut down the affected portions of the Pipeline should any leakage or loss of pressure during operation or pressure testing be detected, and shall...take appropriate follow-up action to prevent any discharge from the Pipeline to the Mackenzie River or other bodies of water.

Part C.9. The Licensee shall undertake an annual inspection for scour in the...vicinity of the Pipeline which may expose or threaten to expose the buried Pipeline...and take appropriate follow-up action.

3. Contingency Planning - DOE felt contingency plans should include means to recover oil from an ice-infested river. This was considered "essential due to the extremely sensitive nature of the areas around and downstream of Norman Wells". DOE suggested that the oil spill response program address the accumulation of oil in "sensitive migratory bird areas downstream", and that Esso continually develop its oil and toxic materials spill response capabilities.

Contingency planning was extensively addressed in the water license. The conditions included (but were not limited to) the development and approval by the Board of 1) an oil spill contingency plan, 2) a hazardous materials contingency plan, and 3) a general contingency

plan. The three plans included the prevention, termination, containment, recovery and disposal of spilled contaminants. With respect to DOE's concern regarding the recovery of oil under ice-infested conditions, the Board required that the oil spill contingency plan describe "a program of studies to demonstrate the capability to contain, recover and to report spills under a variety of environmental conditions, including early and late winter ice conditions and spring River Ice Breakup" (Part F, 2.b).

Esso is required to undertake oil spill recovery exercises and report to the Board the successes and failures experienced and recommendations for improvement. As mentioned earlier, DOE has attended two of these exercises and prepared reports on the review and assessment of the exercises (Gordon, 1986; Simpson, 1986). DOE's concern that spill response capabilities be continually upgraded was also addressed by the Board's requirement that the "contingency plan shall be reviewed annually by the Licensee and modified as necessary to reflect changes in operation and technology" (Part F, 5.).

4. Disposal of Drilling Wastes - DOE requested that all drilling wastes be disposed in land-based sumps (excluding those drilling wastes comprising only bentonite and water). This concern was addressed by the NWT Water Board. "The Licensee shall not discharge drilling fluid waste to the Mackenzie River. All Island drilling fluid wastes must be stored in temporary storage facilities for transportation and disposal to approved sumps" (Part E, 1.).

5. Sewage Treatment - DOE recommended that the Water License include the provision that the domestic sewage discharges meet the requirements of the proposed "Guidelines for Municipal Type Wastewater Discharge in the Northwest Territories". The sewage discharge requirements in the Water License met these requirements.

The NWT Water Board "depends upon a Technical Advisory Committee for advice on a variety of technical issues. This Committee is comprised of representatives of government agencies, industry, native organizations, and the general public" (Wilson and Warner, 1986). DOE has a representative on this committee. Draft licenses for the Great Bear and Mackenzie River crossings (IPL) were given to the Technical Advisory Committee for review and comment. Through this committee, DOE participated in the review of IPL's two water licenses and attended meetings where the licenses were discussed. If the Department had had concerns that weren't being addressed through the conditions of the water licenses, then these concerns would have been raised through the Technical Advisory Committee.

SUMMARY

All of the concerns identified by the Department of Environment with respect to island construction, oilfield development, extraction and production were incorporated into Esso's water license. As of March 1986, Esso had complied with all the conditions of the water license (R. Kent, DIAND pers. comm.). The concerns identified by DOE for the water license were consistent with the departmental concerns raised during the EA Panel review.

7. CONCLUSIONS

7.1. Environmental Assessment Panel Reviews

7.1.1. Norman Wells Project Review

This study has shown that the twelve EA Panel recommendations directly attributable to the Department of Environment's intervention have all been implemented. Although the degree to which they have been incorporated into the Norman Wells Project varies, the intent of each recommendation has been met (i.e. some action has been undertaken by the proponent to address the environmental concern covered by the EA Panel recommendation). All but three (#3, #6, #16) of the twelve recommendations have been fully implemented. It is unlikely that the proponents will undertake further action to realize complete implementation of the remaining three recommendations. (See Section 4 for a description of the status of the recommendations and an understanding of why they were not fully implemented.) This implies that there is no need for further follow-up by DOE to the proponents' compliance with the EA Panel findings for the Norman Wells Project.

The Department does, however, have an interest in examining the effectiveness of EA Panel recommendations aimed at mitigating impacts in the event of an oilspill. This includes those dealing with contingency plans and waterfowl deterrents. For example, if an oilspill were to occur, or if the pipeline or island integrity were threatened, DOE would follow the event to 1) see if recommended mitigation measures worked, 2) determine whether other more effective, mitigation measures may be available and/or 3) see whether impacts could be avoided.

7.1.2 Other EA Panel Reviews

At present there is a departmental policy requiring DOE personnel to undertake follow-up to projects reviewed by EA Panels. It is stated in the

Department of Environment Role in the Federal Environmental Assessment and Review Process (DOE, 1980) that "follow-up activity shall be carried out for all projects given a panel review".

The most effective and efficient means to identify the EA Panel recommendations stemming from DOE's intervention would be to have the involved personnel identify the appropriate recommendations immediately following release of the EA Panel report. This would be quick and straightforward. In order to determine whether DOE's advice is incorporated into the design, construction and operation of the project, further follow-up is required. As noted earlier, because EARP is not legislated, EA Panel recommendations are not required to be incorporated into the project. Ideally, follow-up to evaluate the proponent's compliance with the recommendations should be done both during construction and after operation has commenced. If a recommendation is not being implemented during the construction phase, then the Department may still have an opportunity to convince the proponent to do otherwise or to ensure that the intent of the recommendation is covered under regulatory requirements (such as water licenses and land use permits). Finally, follow-up during operation is necessary to determine whether all recommendations have been implemented.

As was demonstrated through this exercise on the Norman Wells Project, follow-up to EA Panel reviews in which the Department of Environment has been involved is a useful undertaking. If the Department's advice has not been incorporated into EA Panel recommendations, it indicates that the advice is perhaps ineffective and the reasons for being so should be examined. If DOE's advice is incorporated into the recommendations, and hence project construction and operation, then the effectiveness of the advice with respect to environmental protection can be examined.

7.2 Land Use Permits and Water Licences

The Department of Environment did not raise any documented concerns with respect to the Land Use Permits for the Norman Wells Pipeline or the water licenses for the Mackenzie and Great Bear River crossings by IPL. While the reasons for this are not clear, it raises questions regarding DOE's involvement in these approval processes and future follow-up activities.

If the Department did not have any environmental concerns that were not already being addressed by standard conditions used by DIAND or the NWT Water Board, then one of two conclusions can be made:

1. The Department generally has concerns regarding land use permits and water licenses, and the lack of identified concerns for the Norman Wells Pipeline is not typical. Review of these regulatory approvals should continue.

2. For "high profile" projects where there are other governments and regulatory agencies reviewing the project, it may be more efficient and just as effective for the Department to monitor these reviews.

If the Department of Environment has identified concerns, but for various reasons has not recorded them, then the means by which the advice is delivered needs to be examined. If DOE wants to conduct regular follow-up, then efforts will be required to ensure DOE advice is consistently and thoroughly documented in appropriate files.

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APPENDIX 1 * - ENVIRONMENTAL CONCERNS IDENTIFIED BY DOE

CONCERN	RESULT
Oilfield Development	
1. Consideration of alternative technologies to island construction.	1. This concern was addressed in an EA Panel request for further information; Esso prepared response comparing four alternate field recovery techniques. DOE agreed that the construction of artificial islands was needed.
2. Possibility of ice jams/ice ride-up onto islands during spring break-up conditions and subsequently jeopardizing island integrity.	2. EA Panel concluded that the elevation of the islands was high enough to prevent ice build-up and overtopping of islands.
3. Continuous erosion at the base of the islands could undermine them or uncover the underwater pipelines.	3. Two Panel recommendations were made: a) further study on alternatives to filter cloth as a protective barrier; b) further work to more accurately model the forces of erosion and scour
4. "There is no reference to current or projected air emissions ... the proponent states, without evidence, that impacts ... on air quality will be low." Specifically, the concerns were as follows: a) during temperature inversions some air pollutants could be concentrated to a dangerous level; and, b) increased atmospheric emissions could create serious "ice fog" conditions.	4. "Esso did not produce any data which could have been used to either support or disprove these hypotheses. The Panel, therefore, was unable to make any decision other than to recommend that an air quality monitoring program be initiated immediately to provide this baseline information."
5. DOE was concerned that dredging activities would affect fish resources.	5. The issue was addresssed by Esso in response to questions by the Department of Fisheries and Oceans.

* All quotes in Appendix 1 from Bryant (1982) except where noted.

CONCERN	RESULT
6. DOE was concerned with Esso's plan to dump 50% of their drilling wastes into the Mackenzie River	6. The EA Panel "recommended that no drilling wastes other than mixtures of water and bentonite be allowed to enter the Mackenzie River and that land disposal and treatment sites be identified and developed." (FEARO, 1981).
7. Oil spills could potentially have adverse impacts on waterfowl populations.	7. There were two EA Panel recommendations dealing with this issue (15, 16). The EA Panel recommended that: a) construction and drilling activity on the islands stop during the peak spring waterfowl migration; and, b) a plan be developed for keeping bird populations away from oil spill sites. Another related recommendation was "that Esso attempt to improve on the leak detection threshold of $^{+}$3.0% for gathering lines, and that they undertake additional research into oil-spill countermeasures in ice-infested waters" (FEARO, 1981).
8. The EIS should have taken into account cumulative impacts (e.g. the use of IPL's right-of-way as an energy corridor during future developments).	8. "The Panel was unable to offer any specific solutions to this issue other than to reiterate Justice Berger's four-year-old suggestion that: DIAND should take the lead in preparing a preliminary land use plan for the Mackenzie Valley to provide a framework in which the proposed project can be planned and evaluated."
9. There is a potential for adverse pipeline/permafrost interactions.	9. EA Panel recommended that"IPL undertake to publish a more detailed thermal analysis of the pipeline to predict more accuratedly the behaviour of the pipe in a variety of terrain and temperature regimes" (FEARO, 1981).
10. Possibility of oilspills from the pipeline or fuel caches and lack of contingency plans.	10. EA Panel recommended a well-defined contingency plan.

CONCERN	RESULT
11."Mention was also made of the fact that little was known about spill dynamics in permafrost regions and that oil may be channelled underground along the right-of-way or percolate through the active layer. The leak detection threshold for the main pipeline was quoted as being ±0.5%, thus, at a flow rate of 32,000 bpd, a spill of 160 bpd could develop without being detected".	11.Two EA Panel recommendations addressed this concern: "It is recommended that in developing oil spill prevention and contingency plans, IPL make special provisions for the karst terrain near Bear Rock"; and "It is recommended that Esso and IPL develop, test, and evaluate contingency plans for the construction and operation of both the oilfield expansion and pipeline projects and that these plans be reviewed and approved by government prior to the start of construction" (FEARO, 1981).
12."Apparently an environmental rationale was not considered in pipeline route selection." It should be noted that DOE did not raise site-specific concerns.	12."It is recommended that IPL undertake baseline studies on hunted and trapped species to provide information aimed at both the assessment of the impact of the pipeline construction and operation on wildlife, and the development of mitigation measures" (FEARO, 1981).
13."DOE also voiced their concern over the possibility that construction activities might cause severe terrain disturbance, particularly during the late fall and early spring."	13.This concern was not specifically addressed by the EA Panel.

APPENDIX 2 - All Environmental and Engineering Recommendations Made by EA Panel

1. It is recommended that IPL investigate minor alternative routings to keep the pipeline further east from the settlements of Fort Norman and Wrigley.

2. It is recommended that pipeline summer construction be permitted only in areas where it can be clearly demonstrated that there would be no greater impact than winter construction in the same area.

3. It is further recommended that, before the project is authorized, IPL undertake and publish a more detailed thermal analysis of the pipeline to predict more accurately the behavior on the pipe in a variety of terrain and temperature regimes. The analysis should cover the possiblilty of climatic change over the life of the project.

4. It is recommended that detailed and environmentally acceptable plans for the maintenance of the right-of-way and for the repair of pipeline failures be prepared prior to commissioning of the pipeline.

5. It is recommended that terms and conditions for the pipeline project spell out requirements for a revegetation and erosion control program using species, techniques and schedules shown to be adequate for the task.

6. It is recommended that in developing oilspill prevention and contingency plans, IPL make special provisions for the karst terrain near Bear Rock.

7. It is recommended that IPL design, plan, and construct the pipeline so as to minimize the need for extensive maintenance or unscheduled repair activities.

8. It is recommended that river crossings be located so as to minimize overall environmental disruption.

9. It is recommended that the construction plans and schedules for intermediate sized crossings be re-evaluated by IPL in cooperation with the Department of Fisheries and Oceans to ensure that impacts on fish and other aquatic organisms are minimized.

10. It is recommended that Esso carry out a model study to fully evaluate local scour at the artificial islands in order to be certain of the structural safety of the pipelines and integrity of the islands. The study should include monitoring and remedial repair procedures. The results should be reviewed by government before the island construction is authorized.

11. It is further recommended that studies on alternatives to filter cloth protection be carried out to find a material that will ensure that no significant erosion of the islands will occur. Results should be reviewed by government before construction of the islands is authorized.

12. It is recommended that the Proponents consult with the Department of Fisheries and Oceans to address any outstanding fisheries concerns and demonstrate in their construction timing and techniques that they have used the available information and addressed the concerns.

13. It is recommended that further site specific studies be undertaken to determine final alignment for river crossings to prevent or minimize impacts on fish and the aquatic environment.

14. It is recommended that IPL undertake baseline studies on hunted and trapped species to provide information aimed at both the assessment of the impact of the pipeline construction and operation on wildlife, and the development of mitigation measures.

15. It is recommended that construction and drilling activity on the islands stop during the peak spring waterfowl migration period that normally lasts one to two weeks, and that helicopter access to the islands be restricted to only essential needs.

16. It is recommended that Esso develop a plan specifying the necessary equipment and procedures to keep large populations of waterfowl away from an oilspill site.

17. It is recommended that government and IPL fire control responsibilities be clarified prior to commencement of construction and operation of the pipeline. It is further recommended that the government fire control program be augmented to provide protection to the pipeline and, at the same time, that there be no decrease in protection services to other sections, such as highways, settlements and traplines.

18. It is recommended that slash from the right-of-way clearing operation be piled and burned on the right-of-way during the winter.

19. It is recommended that Esso undertake an accelerated research and technology development program on equipment and procedures to deal with oilspills into or under ice-covered and ice-infested river waters. This program should be in place before expanded production begins at Norman Wells.

20. It is recommended that Esso investigate, design and install a more accurate oil-leak detection system at Norman Wells, one that would be consistent with the detection levels of the IPL pipeline to Zama.

21. It is recommended that Esso and IPL develop, test, and evaluate contingency plans for the construction and operation of both the oilfield expansion and pipeline projects and that these plans be reviewed and approved by government prior to the start of construction.

22. It is recommended that Esso prepare contingency plans with methods and procedures for handling, storage, transportation and disposal of all toxic and hazardous materials and that such plans be in place prior to the commencement of the project.

23. It is recommended that Esso commence a montoring program for ground level concentrations of air emissions in the Norman Wells area and that this monitoring continue throughout the life of the project.

24. It is recommended that no drilling wastes other than mixtures of water and bentonite be allowed to enter the Mackenzie River and that land disposal and treatment sites be identified and developed.

25. It is recommended that the responsible Federal and GNWT agencies further review the details of IPL's proposed archaeological program, and monitor the potential impact of this project on the archaeological resources along the pipeline route.

26. It is recommended that, in consultation with the GNWT, the Department of Environment, DIAND or a contracted non-government agency carry out an evaluation of the impact management process in order to improve on impact evaluation and mitigation on the Norman Wells and future projects.

27. It is recommended that the GNWT and Federal Government work with the Proponents to establish an effective and ongoing public information program to respond to concerns of Mackenzie Valley residents.